

**TEAM 2025111**

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# 1.Introduction

## 1.1 Overview

Mindflix represents an innovative AI-powered solution to revolutionize employee well-being monitoring and support in large organizations. This intelligent platform transforms traditional employee mood tracking into a dynamic, conversational support system that provides immediate, personalized assistance while generating actionable insights for organizational leadership.



## 1.2 Purpose and Scope

Mindflix integrates multiple data streams to provide automated, intelligent employee support:

- Processes daily sentiment data through Vibemeter integration
- Analyzes employee activity, leave, and performance metrics
- Identifies at-risk employees using ML-driven scoring
- Initiates proactive AI conversations based on risk levels
- Escalates critical cases to HR when risk thresholds exceed

## 1.3 Target Users



### Primary Stakeholders:



#### Employees

- Receive proactive wellness check-ins
- Access immediate AI-powered support
- Connect with appropriate mentors



#### HR Teams

- Monitor real-time risk alerts
- Access prioritized cases
- Track team wellness metrics



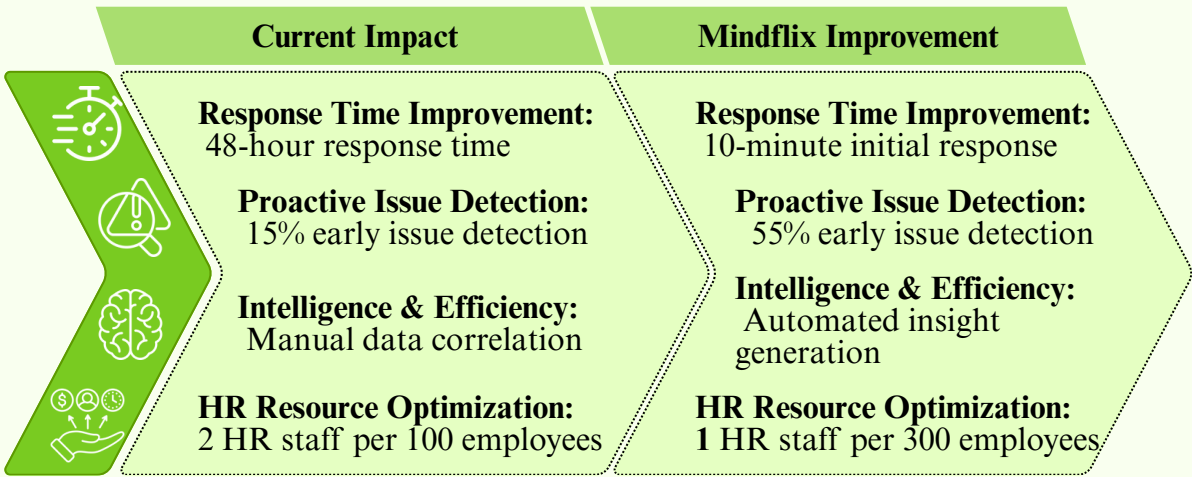
#### Mentors

- Provide specialized guidance
- Follow up on identified concerns

## 1.4 Current Challenges

Issue	Our Solution
Manual analysis delays	Automated prioritization using multi-source data.
Reactive HR support	Proactive chatbot interactions triggered by risk_score.
Data Utilization Gaps	Unified data pipeline (Vibemeter + HR systems).
Delayed issue detection	Real-time analysis and early warning system
Communication barriers	Multi-channel support with 24/7 availability

## 1.5 Impact Analysis



## 2. Solution

Mindflix's solution architecture is built upon three fundamental pillars: data integration, intelligent processing, and interactive support. Our approach transforms traditional employee support systems into a proactive, AI-driven platform that scales efficiently while maintaining personalized care.

### 2.1 System Overview.

At its core, Mindflix operates through a sophisticated integration of multiple data sources and AI systems. The platform continuously monitors employee well-being indicators, processing Vibemeter responses, performance metrics, leave patterns, and activity data. This comprehensive data collection enables our system to understand each employee's current state holistically.

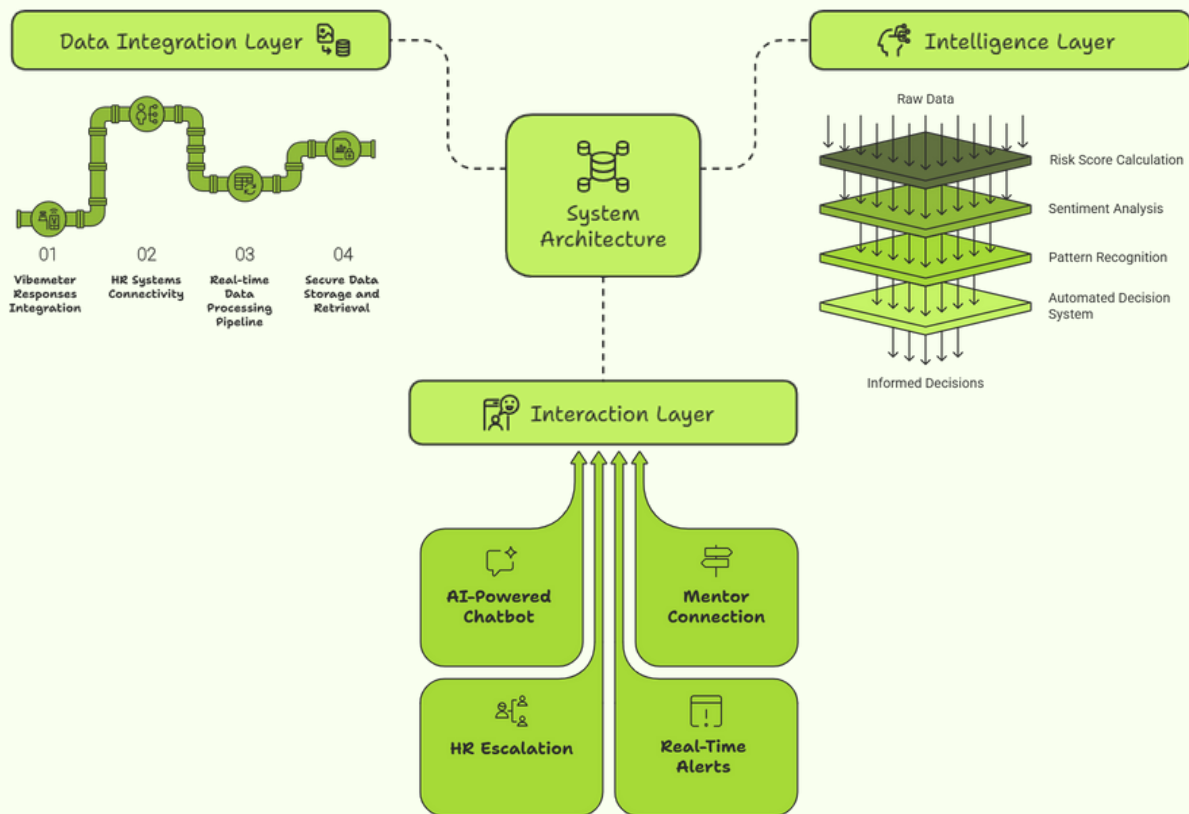
The intelligence layer employs advanced machine learning algorithms to analyze this integrated data, generating risk scores and identifying patterns that might indicate potential wellness concerns. This predictive capability allows the system to initiate conversations proactively rather than waiting for employees to report issues.

### 2.2 Interaction Framework

Our conversational AI system utilizes a multi-LLM approach, where different language models are orchestrated based on the specific requirements of each interaction. The primary chatbot interface engages employees in natural, context-aware conversations, gathering information while providing immediate support.

When certain risk thresholds are met or specific patterns are detected, the system automatically routes cases to appropriate mentors or HR professionals. This intelligent routing ensures that human intervention occurs precisely when needed, optimizing resource allocation while maintaining high-quality support.

## System Architecture for Data and Interaction



### 2.3 Technical Innovation

Mindflix's innovative approach lies in its ability to maintain context throughout the entire support process. The system's graph database structure allows for complex relationship mapping between various data points, enabling a more nuanced understanding of employee situations. Our dynamic question generation system adapts in real-time based on conversation flow and employee responses, ensuring relevant and meaningful interactions.

The platform's real-time analytics engine continuously processes incoming data, instantly updating risk assessments and recommendations. This allows for immediate response to critical situations while maintaining a comprehensive view of organizational well-being trends.

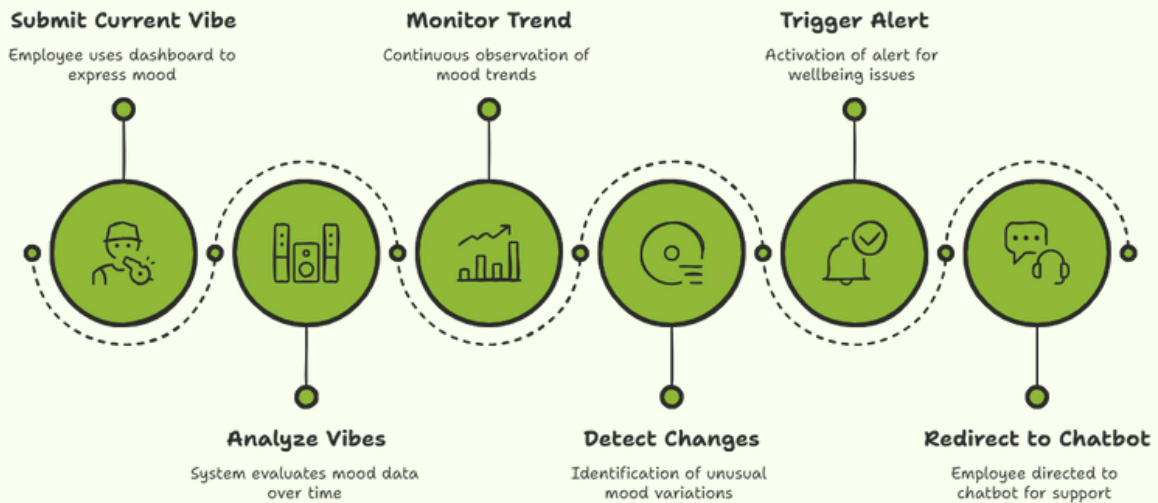
## 3. User Flow Architecture

Mindflix's architecture is designed to create seamless, intuitive workflows for both employees and HR professionals. Our platform facilitates proactive well-being support through carefully orchestrated user journeys and data-driven interactions.

### 3.1 Employee Journey

The employee experience begins with our intelligent mood-tracking system. Employees can easily record their emotional state through the dashboard using our five-point Vibemeter scale: Frustrated, Sad, Okay, Happy, or Excited. This simple yet powerful interface is the primary entry point for well-being monitoring.

### Employee Journey Mapping



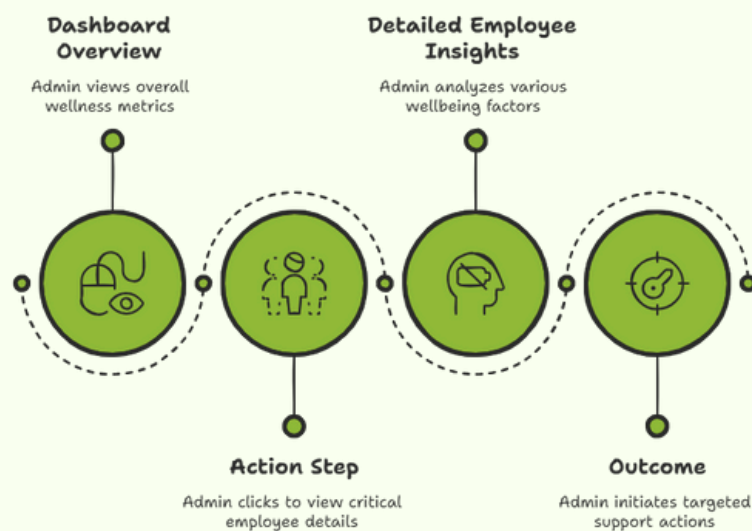
Behind this straightforward interaction lies a sophisticated analysis system. Mindflix continuously monitors these mood submissions, building personalized vibe trends for each employee. The platform's intelligence layer analyzes these trends in real-time, looking for patterns or changes that might indicate potential well-being concerns.

The system automatically triggers a Wellbeing Alert when it detects notable changes or concerning patterns. This alert manifests as a gentle prompt in the employee's dashboard, encouraging them to engage with our AI-powered reflection chatbot. This proactive approach ensures that support is offered before issues escalate while maintaining employee privacy and autonomy.

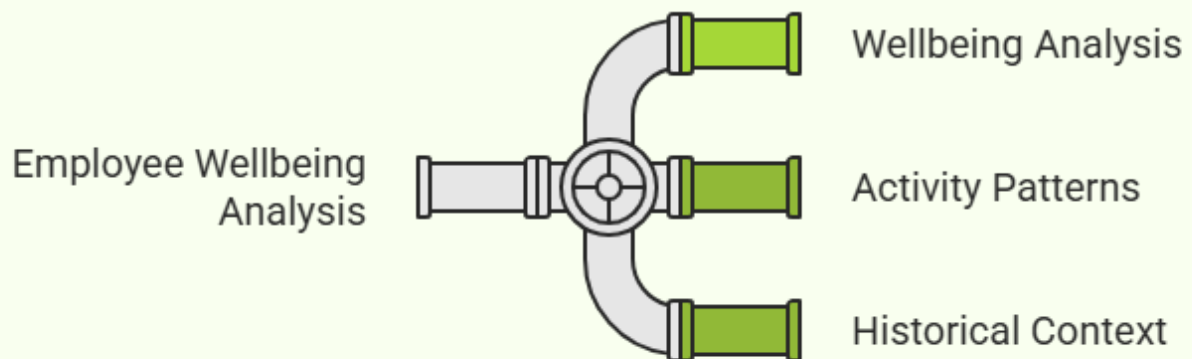
## 3.2 HR Management Flow

The HR interface serves as a comprehensive command center for organizational well-being management. At its core, the dashboard provides immediate visibility into critical metrics, including overall risk scores, wellness trends, and the number of employees requiring attention.

### HR Interaction Points Sequence



When reviewing high-risk cases, HR professionals can access detailed insight cards that comprehensively view each employee's situation.



These cards consolidate multiple data points including:

**Wellbeing Analysis:**

A detailed assessment of the employee's current state, combining Vibemeter trends with other behavioural indicators.

**Activity Patterns:**

Comprehensive analysis of work patterns, including engagement levels and potential signs of burnout.

**Historical Context:**

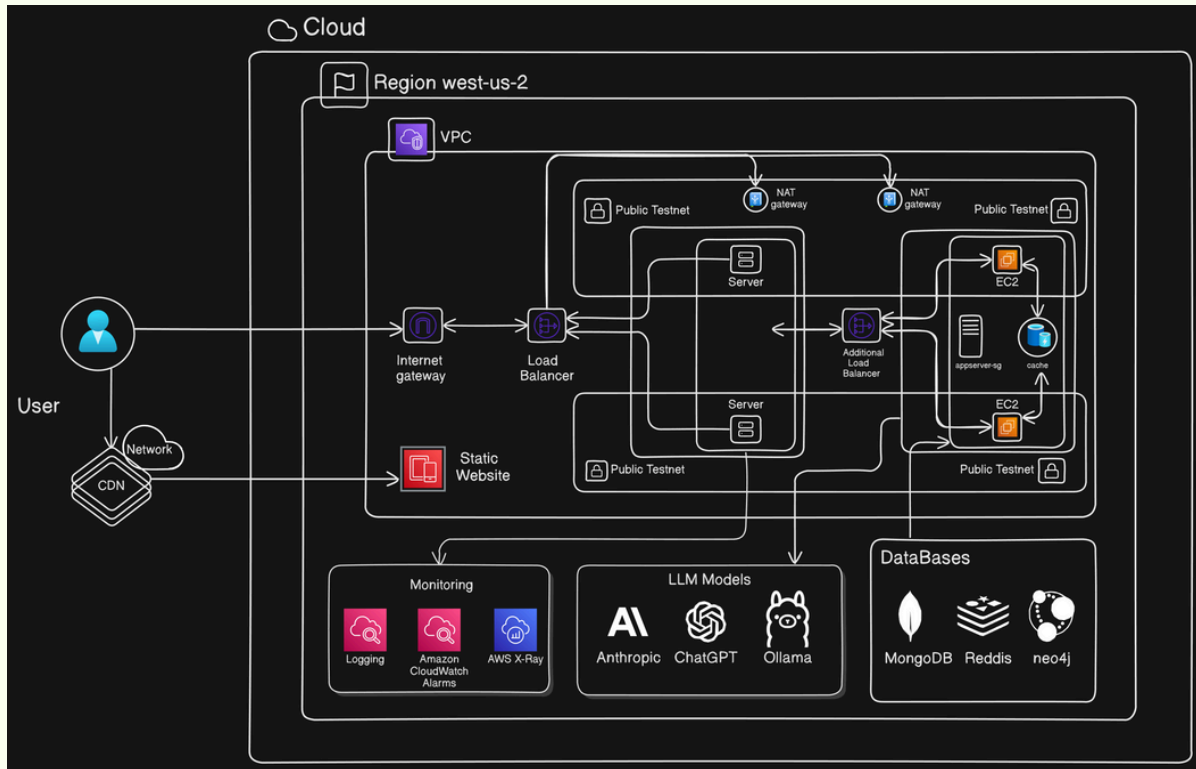
Integration of performance trends, leave patterns, and significant workplace transitions.

This consolidated view enables HR teams to make informed decisions about intervention strategies and support allocation. The system's intelligence layer assists in prioritizing cases and suggesting appropriate support pathways, whether through mentor assignment, direct HR intervention, or automated support resources.

Through this structured yet flexible approach, Mindflix ensures that employees and HR professionals are equipped with the necessary tools, insights, and support to foster a workplace culture of well-being and resilience. By seamlessly integrating proactive monitoring, personalized guidance, and timely interventions, the platform addresses individual needs and enables HR teams to respond strategically to emerging trends and concerns. This holistic model creates a robust support system that adapts to organizational complexity and scales effectively across large, diverse workforces.

## 4. System Design

Mindflix implements a sophisticated cloud-native architecture for scalability, security, and high availability. The system leverages AWS infrastructure in the US-West-2 region, incorporating multiple specialized databases and advanced LLM integrations to deliver comprehensive employee well-being support.



**Fig. System Design**

The frontend application utilizes AWS CloudFront's content delivery network, ensuring optimal performance and immediate platform access across global locations. Our core infrastructure resides within a Virtual Private Cloud, implementing a multi-tier architecture across multiple availability zones for maximum reliability and security.

The application layer runs on EC2 instances with FastAPI backend services, managing conversation flows, data analysis, and mentor matching through an efficient load-balanced system. Our data management leverages specialized databases - MongoDB for conversation histories, Neo4j for question relationships, and Redis for high-speed caching - ensuring optimal performance and quick data retrieval.

The system integrates multiple Large Language Models through a flexible architecture supporting cloud-based services and local deployment options, optimizing response times while maintaining cost efficiency. Comprehensive monitoring through CloudWatch and X-Ray provides real-time insights into system performance, enabling proactive issue detection and consistent service quality.



## 5. Employee Selection Engine

The diagram represents a data processing workflow for identifying employees with low emotional scores through direct measurement or predictive analysis.

### 5.1 Data Collection and Preprocessing

The six distinct datasets capture different aspects of employee metrics. These datasets contain multiple entries per employee with varying dates; not all employees appear in every dataset.

Each dataset undergoes preprocessing, where data is pivoted to align entries by the employee; new metrics are created by applying weights to dataset features, defining the dataset's overall contribution. These weights are derived using the Automated Weight Justification Framework based on the Analytic Hierarchy Process (AHP), which systematically assigns importance to features. In the end, temporal decay is applied to prioritize recent metrics over old metrics.

### 5.2 Data Integration

After preprocessing, datasets are merged into a unified view. The merged dataset contains missing values where employees don't have records in all sources.

### 5.3 Missing Data Handling

Multivariate Imputation by Chained Equations (MICE) fills missing numerical values by finding the nearest matching metrics, while categorical columns like Vibemeter emotions remain untouched.

### 5.4 Data Categorization

The imputed dataset is divided into three segments:  
SCORE=1-2: Employees reporting sad/frustrated emotions  
SCORE=3-5: Employees reporting positive emotions  
SCORE=EMPTY: Employees with no emotion data

### 5.5 Model Training and Prediction

A Random Forest model is trained using the SCORE=1-2 (sad/frustrated) dataset as ground truth. This approach considers all self-reported negative emotions regardless of their metric values. The model extracts weights revealing relationships between five key metrics. These weights are applied to predict the emotional states of all employees, including those without self-reported data.

### 5.6 Employee Identification

The final selection criteria identify employees who self-reported as sad/frustrated (SCORE=1-2 from original Vibemeter) or were predicted as sad/frustrated by the model. An analyzed profile is generated for each employee and contains all five metrics: predicted and actual emotions if they exist.

The predictive approach can identify potentially at-risk employees who may self-report as happy but show metric patterns indicating approaching burnout or breaking point.

## 5.7. Data Pipeline

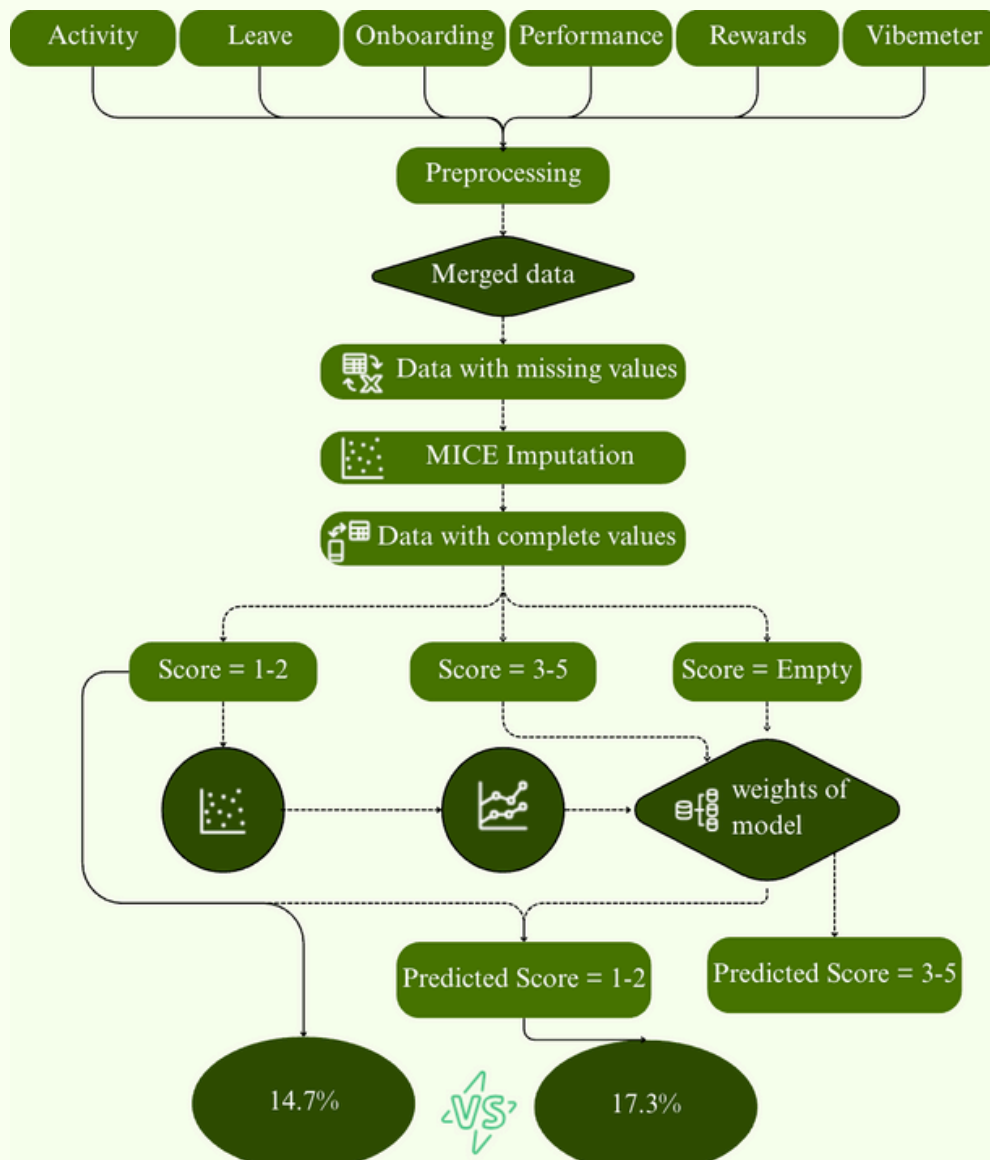


Fig. The diagram represents a data processing workflow for identifying employees with low emotional scores through direct measurement or predictive analysis.

Analyzed Profile Keys	Description
Activity_Interaction_Decay	Work patterns and interactions
Leave_Day_Decay	Time-off data
Onboard_Last_Category	Integration information
Per_Score_Decay	Work effectiveness metric
Award_Count	Recognition data
Actual_Emotion	Actual emotional state measurements
Predicted_Emotion	Predicted emotional state measurements

## 5.8 Automated Weight Justification Framework Using Analytic Hierarchy Process (AHP)

This algorithm provides a rigorous mathematical foundation for justifying the weighting schemes used across different datasets. The Analytic Hierarchy Process (AHP) approach creates a consistent, objective framework for weight determination.

Input: Set of criteria  $C = \{c_1, c_2, \dots, c_n\}$

$a_{ij}$  represents how much more important criterion  $i$  is than  $j$

Output: Weights  $W = \{w_1, w_2, \dots, w_n\}$  and Consistency Ratio CR

### Mathematical Foundation

#### Pairwise Comparison Matrix

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ \frac{1}{a_{12}} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \cdots & 1 \end{bmatrix}$$

#### Eigenvalue Calculation:

$$(A - \lambda_{\max} I)\mathbf{v} = 0$$

where  $\lambda_{\max}$  is the principal eigenvalue and  $\mathbf{V}$  the corresponding eigenvector.

#### Weight Normalization

$$w_i = \frac{v_i}{\sum_{j=1}^n v_j} \quad \forall i \in \{1, 2, \dots, n\}$$

Here we normalize the Eigen Vector to obtain the weights

#### Consistency Validation

This validation ensures the logical coherence of pairwise comparisons during the Analytic Hierarchy Process (AHP).

$$CI = \frac{\lambda_{\max} - n}{n - 1}, \quad CR = \frac{CI}{RI}$$

CI is the consistency index, CR is a ratio, and RI is the random index for matrix size  $n$ . Weights are accepted if  $CR < 0.1$ . And the weights are considered coherent.

## 5.9 Temporal Decay Scoring Algorithm

The algorithm addresses the challenge of reconciling historical patterns with recent responses. The mathematical formulation enables automated adaptation to changing workforce dynamics while maintaining interpretability for HR decision-making.

#### 1. Decay Factor Calculation

$$\text{DecayFactor}(t) = e^{-\alpha t - \beta t_{\text{staleness}}}$$

#### 2. Internal Weighting System

$$w_i = \frac{e^{-\alpha t_i}}{\sum_{j=1}^n e^{-\alpha t_j}}$$

#### 3. Freshness Adjustment

$$\text{Freshness} = e^{-\beta t_{\text{staleness}}}$$

#### 4. Final Score Composition

$$\text{FinalScore} = \left( \sum_{i=1}^n w_i s_i \right) \cdot \text{Freshness} + b(1 - \text{Freshness})$$

## 6. Chatbot Framework

Mindflix's conversational AI framework represents a sophisticated approach to employee well-being support, combining intelligent analysis with empathetic interaction. This framework enables personalized, context-aware conversations while maintaining scalability and consistency across large organizations.

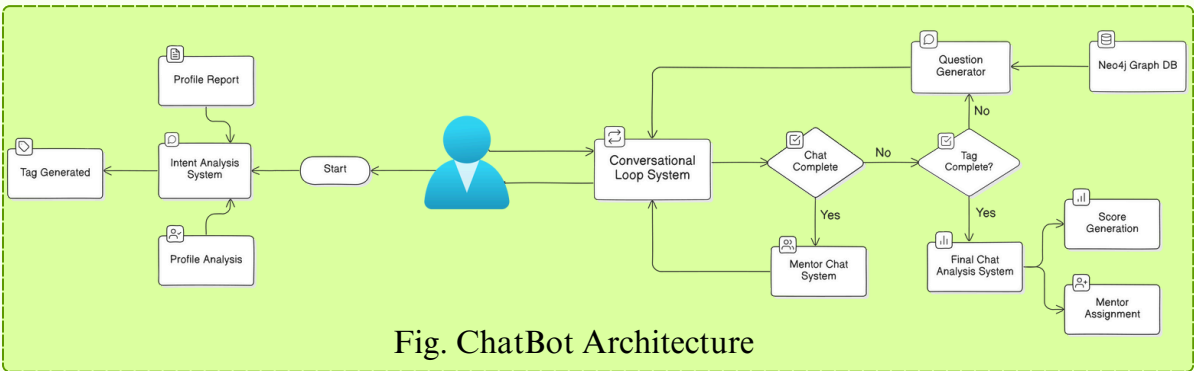
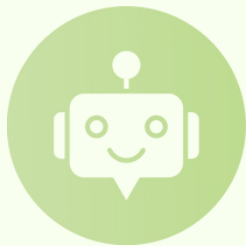


Fig. ChatBot Architecture

### 6.1 Core Intelligence Components

#### Data-Driven Dialogue Direction

At the heart of Mindflix's chatbot lies the Intent Analysis Engine, which processes comprehensive employee data to establish conversation direction and priority. This engine analyzes multiple data points, including performance metrics, leave patterns, and activity data, to generate weighted tags that guide the conversation flow. These tags ensure that discussions focus on the most relevant aspects of employee well-being while maintaining natural dialogue progression.

#### Dynamic Question Management

The Dynamic Question Management system, powered by our Neo4j Graph Database, maintains a sophisticated network of context-aware questions. Rather than following rigid conversation scripts, the system adaptively selects and generates questions based on the current context, employee responses, and historical interaction patterns. This approach ensures that each conversation feels natural and personalized while systematically addressing identified concerns.

### 6.2 Conversation Management System

#### Structured Conversation Limits

Our conversation flow controller implements structured limits to ensure adequate support delivery: a maximum of three questions per identified topic and an overall limit of ten questions per session. These boundaries help maintain focused, productive conversations while preventing conversation fatigue. When critical issues are detected, the system can override these limits and initiate immediate escalation protocols.

### Real-Time Response Evaluation

The Response Analysis System continuously evaluates employee inputs in real-time, assessing content and sentiment. This analysis determines whether a topic has been adequately covered or requires further exploration, enabling smooth transitions between different areas of concern while maintaining conversation coherence.

## 6.3 Conversation Completion and Handoff

### Smart Escalation to Human Support

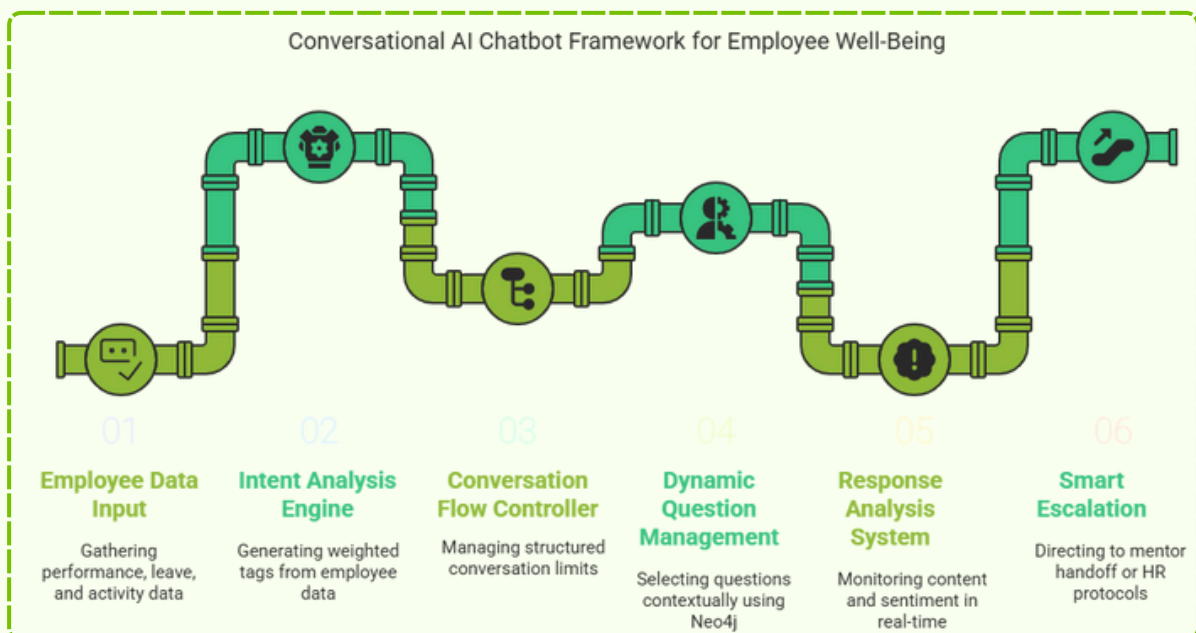
Mindflix facilitates seamless transitions to appropriate support channels as conversations reach their natural conclusion. The system maintains a roster of specialized mentors, each with specific expertise areas such as productivity coaching, career guidance, or work-life balance support. These mentors are automatically notified when conversations indicate that their particular expertise would be beneficial.

### Mentor Handoff and HR Escalation Protocols

The system initiates a warm handoff to the selected mentor for standard cases, providing them with relevant context for conversation while maintaining employee privacy. In cases where critical issues are detected, the system can trigger immediate HR escalation protocols, ensuring urgent concerns receive prompt attention.

### Hybrid Support & Ongoing Monitoring

Combining AI-driven initial support with specialized human guidance, this hybrid approach ensures that employees receive the most appropriate form of assistance while optimizing resource allocation. The system continues to monitor ongoing mentor-employee interactions, maintaining conversation history and context to support future engagements.

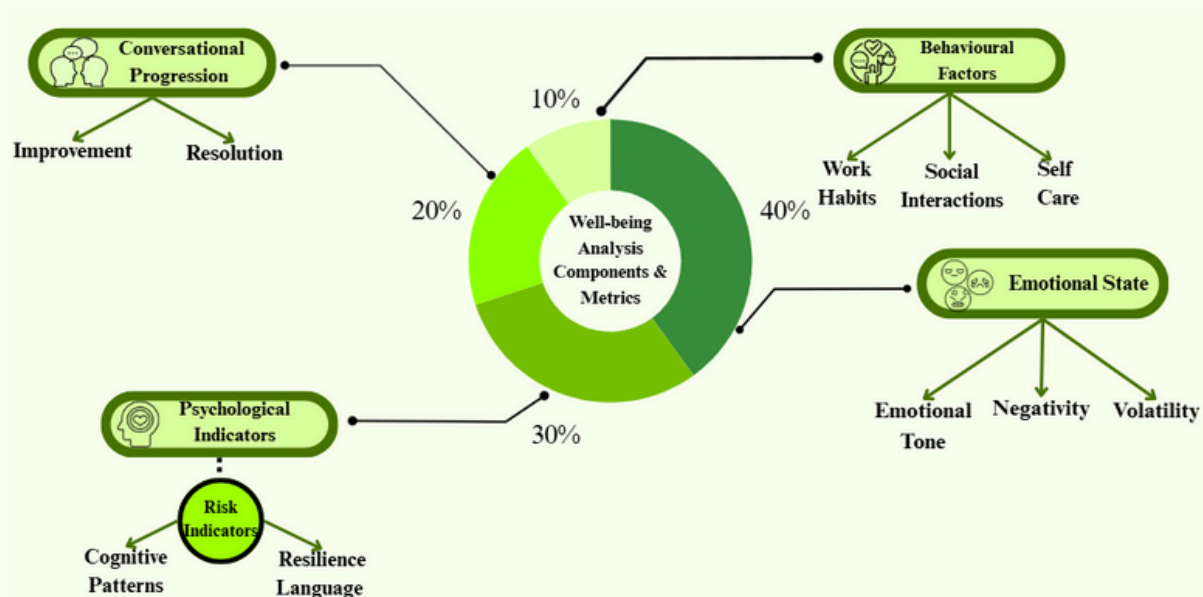


## 7. Post Chat Analysis System

Mindflix's post-chat analysis system serves dual purposes: determining appropriate support pathways and generating comprehensive employee well-being reports. This system combines detailed scoring mechanisms with intelligent support matching to ensure optimal intervention while providing valuable insights to HR teams.

### 7.1 Comprehensive Scoring Framework

Our analysis framework evaluates conversations across four crucial dimensions, each contributing to a holistic understanding of employee well-being:



#### Emotional State Analysis (40% weighting)

The system analyzes tone, sentiment shifts, and emotional cues to assess an employee's well-being and emotional stability throughout the conversation.

#### Psychological Indicators (30% weighting)

This dimension analyzes cognitive patterns and resilience, detecting risk language and coping cues to assess psychological readiness and support needs.

#### Conversation Progression (20% weighting)

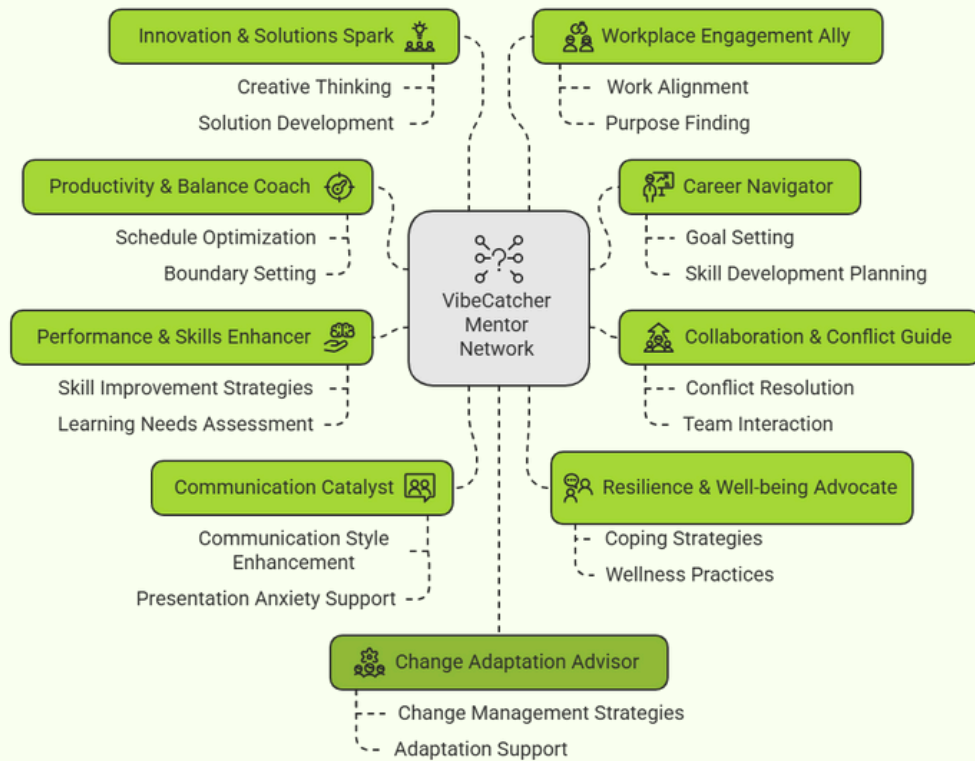
The system evaluates engagement by tracking conversation flow, response patterns, topic depth, and signs of resolution.

#### Behavioral Factors (10% weighting)

The system analyzes behavioral cues from the conversation and links them with activity data to spot areas needing support.

## 7.2 Mentor Assignment System

Fig. types of Mentors



The system utilizes conversation analysis to make intelligent support assignments:

### Expertise Matching

Based on the identified needs and risk levels, the system matches employees with appropriate mentors from our specialized network. This matching considers the primary concerns identified and any secondary support needs that emerged during the conversation.

### Critical Issue Protocol

When severe distress signals or policy violations are detected, the system bypasses standard mentor assignment and triggers immediate HR intervention. This ensures urgent situations receive prompt attention while maintaining appropriate escalation protocols.

## 7.3 Continuous Monitoring

The analysis system maintains ongoing oversight of support effectiveness:

- Regular progress assessments
- Support pathway adjustments
- Outcome tracking
- Impact measurement



## 8. Deployment Guide

Mindflix's deployment architecture implements a microservices-based approach, separating the system into two main components: a robust FastAPI backend service and a responsive React frontend application.

This architectural decision ensures Scalability:

The system utilizes containerization through Docker, enabling independent scaling of front-end and back-end services based on demand. The FastAPI backend leverages asynchronous processing capabilities, handling multiple concurrent conversations efficiently, while the React frontend implements lazy loading and optimized rendering for smooth user experience even under high load.

### Backend Deployment



```
git clone <repository-url>
# Create `.env` file:

# Install UV
curl -LsSf https://astral.sh/uv/install.sh | sh
# Setup and Run
uv init
uv add -r requirements.txt
uvicorn app:app --host 0.0.0.0 --port 8569 --reload --env-file
.env

# Build and run container
docker compose up --build -d
# View running containers
docker compose ps
# Check logs
docker compose logs -f
```

### Frontend Deployment



```
git clone <repository-url>
# Create `.env` file:
# VITE_API_URL=http://localhost:8569

# Install dependencies
npm install
# Run development server
npm run dev

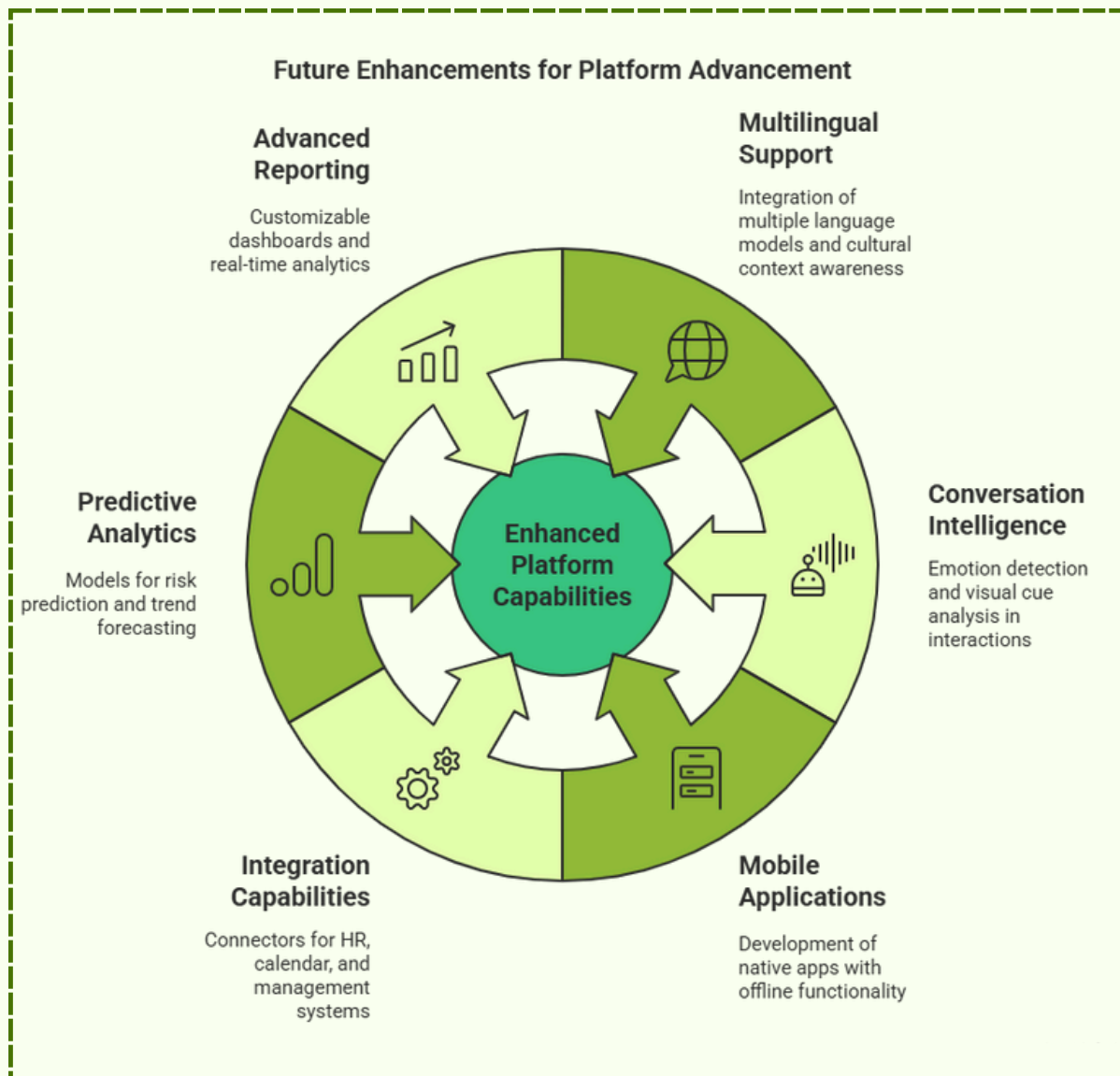
# Build and run container
docker compose up --build -d
# Check status
docker compose ps
# View logs
docker compose logs -f
```



## 9. Future Aspects and Conclusion

Mindflix represents a transformative approach to employee well-being management, successfully bridging the gap between automated efficiency and personalized care. Our implementation demonstrates how artificial intelligence can be effectively leveraged to create meaningful employee support systems that scale across large organizations.

The platform's technical innovations have significantly impacted organizational well-being management. Through the orchestration of multiple language models and sophisticated data integration, we've created a system that understands and responds to employee needs with remarkable accuracy. The implementation of dynamic question generation and context-aware conversations has enabled more natural and effective interactions, while our advanced mentor-matching algorithms ensure appropriate human intervention when needed.



# ANNEXURE

# Demo

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**Frontend URL:** <http://mindflix.tech/>

**Backend URL:** <http://backend.mindflix.tech/>

## Employee Login Credentials

Email - EMP0502@deloitte.com  
Password - root

Email - EMP0508@deloitte.com  
Password - root

## HR Login Credentials

Email - HR00001@deloitte.com  
Password - root

Email - HR00002@deloitte.com  
Password - root

# References

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1. <https://openworks.wooster.edu/cgi/viewcontent.cgi?article=7071&context=independentstudy>
2. [https://en.wikipedia.org/wiki/Weighted\\_sum\\_model](https://en.wikipedia.org/wiki/Weighted_sum_model)
3. <https://icmai.in/upload/Students/Syllabus2016/Inter/Paper-9-April-2021.pdf>
4. <https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestClassifier.html>
5. <https://www.kaggle.com/code/leedonghyeok/multiple-imputation-mice>
6. <https://blog.mitsde.com/data-imputation-techniques-handling-missing-data-in-machine-learning/>

# Question Bank

---

Here are the top 5 questions corresponding to each tag.

## Job Satisfaction Concerns

1. Have there been any recent changes in your role or responsibilities that might be impacting how you feel?
2. Is there a gap between your expectations from the company and how it's unfolding in practice?
3. Is there something specific that's keeping you from feeling more positive about your work experience?
4. Do you feel the performance criteria are clear and aligned with your role responsibilities?
5. Do you feel your current tasks align with your strengths, or could adjustments better support your growth?

## Work Overload Stress

1. Do you clearly understand your top work priorities, and do they feel manageable to you?
2. I notice you've been logging [X] hours per week, which is above average. How sustainable do you feel this workload is for you?
3. Are there specific times of day or recurring situations where your workload feels most overwhelming?
4. How do you perceive the expectations for your role, and are they achievable with your current workload?
5. How do you prioritize tasks when juggling multiple high-activity projects simultaneously?

## Feeling Undervalued

1. Do you feel your voice is not being heard in team discussions and decision-making processes?
2. Do you feel your skills and abilities are being fully utilized in your current position?

# Question Bank

---

Here are the top 5 questions corresponding to each tag. For more questions, please refer to the .zip file

## Job Satisfaction Concerns

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## Feeling Undervalued

1. Do you feel your voice is not being heard in team discussions and decision-making processes?
2. Do you feel your skills and abilities are being fully utilized in your current position?

## Question Bank

---

3. How supported do you feel when you need to take time off unexpectedly?
4. Are there achievements or efforts you've made that you feel went unnoticed? If so, would you like help in formally highlighting them?
5. Do you feel comfortable discussing your leave needs openly with your manager or team?

### Lack of Work Life Balance

1. Do you feel your voice is not being heard in team discussions and decision-making processes?
2. Do you feel your skills and abilities are being fully utilized in your current position?
3. How supported do you feel when you need to take time off unexpectedly?
4. Are there recurring personal or health matters that we could better accommodate with adjusted work arrangements?
5. Do you feel you can fully disconnect from work during time off, or are there barriers to unplugging?

### Career Concerns

1. How does your current workload align with your long-term career or professional goals?
2. Are there collaborative opportunities with teammates that might help strengthen weaker areas?
3. Would additional leadership responsibilities or high-visibility projects help strengthen your case for the next promotion cycle?
4. Would a structured performance and career check-in with leadership every few months help you stay on track toward your goals?
5. Would you be open to exploring internal mobility opportunities in case another role better aligns with your career growth aspirations?

### Workplace Conflict

1. To improve your work environment, would you be open to an internal team reassignment or alternative reporting structure?

## Question Bank

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2. If you feel your manager's actions are impacting your performance or wellbeing, would you like to explore mentorship under a different leader?
3. If you're facing challenges with your manager's leadership style, would you prefer a mediated discussion to address key concerns?
4. If you feel your manager's actions are impacting your performance or wellbeing, would you like to explore mentorship under a different leader?
5. Would you like me to initiate a formal feedback process so leadership can address these management concerns effectively?

### Performance Pressure

1. Do you feel there's an unspoken expectation to limit time off in your team or department?
2. Do you feel the performance expectations are realistic given your current resources and support?
3. Would breaking down performance goals into smaller, achievable steps help reduce pressure and improve progress?
4. How confident do you feel about improving your performance in the current environment?
5. How frequently would you prefer to check in on progress toward your performance goals?

### Recognition Gap

1. Do you feel your impact is fully recognized by colleagues and leadership?
2. Do you feel you received clear feedback about areas for improvement?
3. Is there work you're proud of that hasn't been highlighted enough?
4. How does recognition (or lack of it) affect your drive to take on new challenges?
5. What types of recognition would be most meaningful to you-public acknowledgment, awards, bonuses, or career advancement?

## Automated Weight Justification Framework Using Analytic Hierarchy Process (AHP) : Implementation Algorithm

---

FUNCTION AHP\_Analysis(criteria\_names, comparison\_matrix, current\_weights, RI\_values)

/\* Initialize variables \*/

$n \leftarrow \text{LENGTH}(\text{criteria\_names})$

$A \leftarrow \text{comparison\_matrix}$

/\* Calculate dominant eigenvalue and eigenvector using Power Method \*/

/\* Initialize guess vector \*/

$X \leftarrow [1, 1, \dots, 1]$  // Vector of size n

$\lambda_{\text{old}} \leftarrow 1$

tolerance  $\leftarrow 0.0001$

REPEAT

/\* Matrix multiplication ( $A * X$ ) \*/

$X_{\text{new}} \leftarrow \text{MULTIPLY\_MATRIX\_VECTOR}(A, X)$

/\* Find largest absolute value in  $X_{\text{new}}$  \*/

$\lambda_{\text{new}} \leftarrow \text{ABSOLUTE\_VALUE}(X_{\text{new}}[1])$

FOR  $i = 2$  TO  $n$

IF  $\text{ABSOLUTE\_VALUE}(X_{\text{new}}[i]) > \lambda_{\text{new}}$  THEN

$\lambda_{\text{new}} \leftarrow \text{ABSOLUTE\_VALUE}(X_{\text{new}}[i])$

END IF

END FOR

/\* Normalize  $X_{\text{new}}$  \*/

FOR  $i = 1$  TO  $n$

$X[i] \leftarrow X_{\text{new}}[i] / \lambda_{\text{new}}$

END FOR

/\* Check convergence \*/

IF  $\text{ABSOLUTE\_VALUE}(\lambda_{\text{new}} - \lambda_{\text{old}}) \leq \text{tolerance}$  THEN

BREAK

END IF

$\lambda_{\text{old}} \leftarrow \lambda_{\text{new}}$

UNTIL convergence

$\lambda_{\text{max}} \leftarrow \lambda_{\text{new}}$

/\* Normalize eigenvector to get AHP weights \*/

$\text{sum\_X} \leftarrow \text{SUM}(X)$

FOR  $i = 1$  TO  $n$

$X[i] \leftarrow X[i] / \text{sum\_X}$

END FOR



## Automated Weight Justification Framework Using Analytic Hierarchy Process (AHP) : Implementation Algorithm

---

```
ahp_weights ← ROUND(X, 3)

/* Calculate Consistency Index (CI) */
CI ← (lambda_max - n) / (n - 1)

/* Calculate Consistency Ratio (CR) */
IF n IN RI_values THEN
    CR ← CI / RI_values[n]
ELSE
    CR ← 0
END IF

/* Check if matrix is consistent */
is_consistent ← CR < 0.1

/* Compare with current weights */
weight_diff ← EMPTY ARRAY of size n
FOR i = 1 TO n
    weight_diff[i] ← ABSOLUTE_VALUE(ahp_weights[i] - current_weights[i])
END FOR
max_diff ← MAXIMUM(weight_diff)

/* Create weight comparison dictionary */
weight_comparison ← EMPTY DICTIONARY
FOR i = 1 TO n
    weight_comparison[criteria_names[i]] ← [ahp_weights[i], current_weights[i]]
END FOR

/* Return results */
RETURN {
    "criteria": criteria_names,
    "ahp_weights": ahp_weights,
    "current_weights": current_weights,
    "lambda_max": lambda_max,
    "CI": CI,
    "CR": CR,
    "is_consistent": is_consistent,
    "max_weight_diff": max_diff,
    "weight_comparison": weight_comparison
}
END FUNCTION
```